Persistance and change in coordinated market economies: the case of venture capital for biotechnology in Switzerland

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WORKING PAPER

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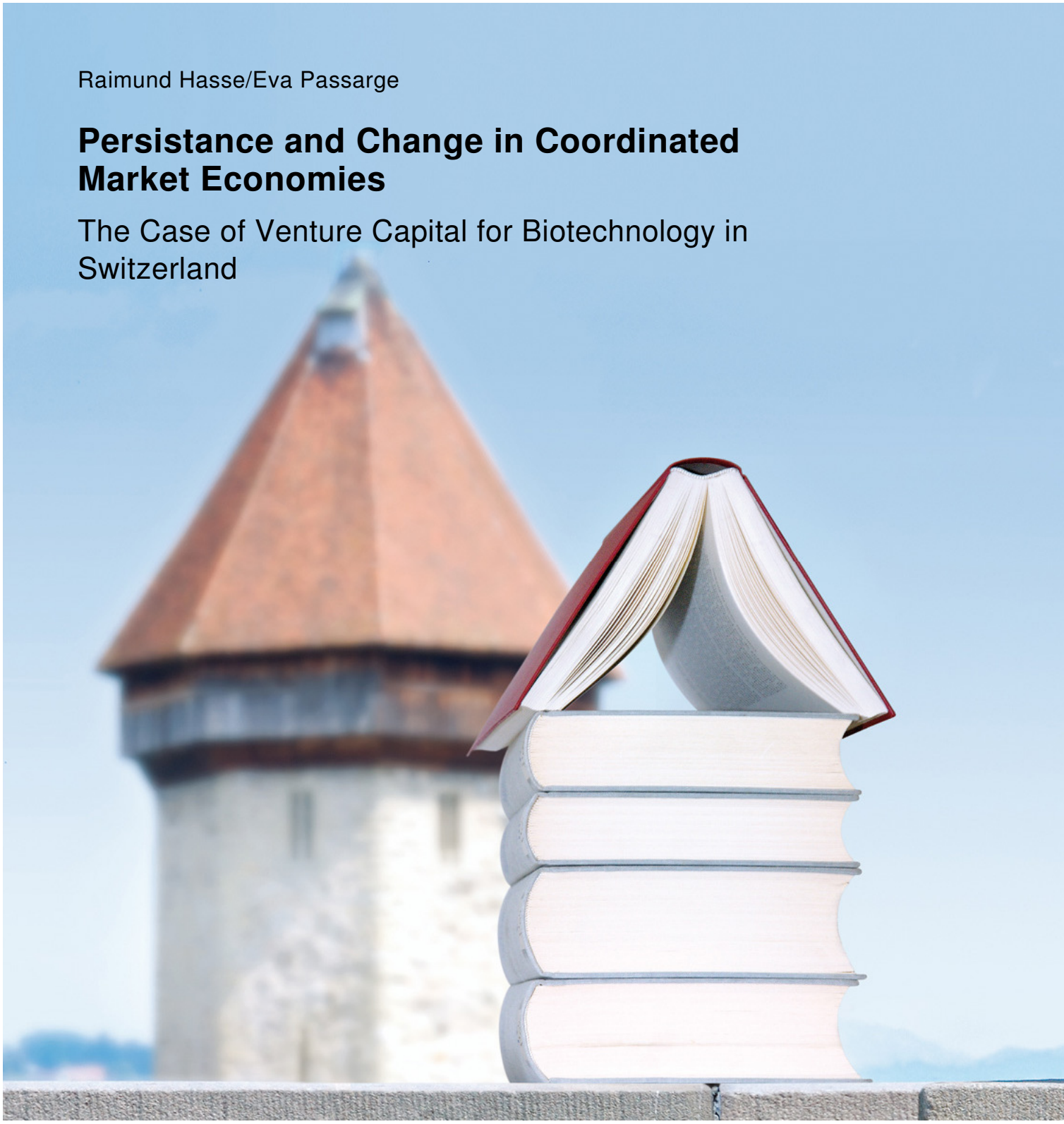
The Case of Venture Capital for Biotechnology in Switzerland



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Persistence and Change in Coordinated Market Economies – The Case of Venture Capital for Biotechnology in Switzerland

Abstract: The institutional configuration of Switzerland resembles the ideal type of coordinated market economies (CMEs) which are said to be highly supportive for incremental innovations but not for radical innovations like biotechnology. Therefore, the emergence and success of Swiss biotechnology comes as a surprise. Against this background, our paper deals with the biotechnology sector in Switzerland. Special attention will be drawn on venture capital. It can be shown that Switzerland has formed a specific variant of venture capital which nicely has adapted to its institutional context. The case thus indicates that technological innovations have the effect that some elements of LMEs can be incorporated into CMEs. However, this occurs incrementally and in accordance with the overall institutional configuration.

Introduction

In the last decades, researchers have found evidence for profound and robust differences of national economies (Piore and Sabel, 1984; Whitley, 1999). On that basis a distinction between two modes of capitalism has been established: Liberal market economies (LMEs) and coordinated market economies (CMEs) (Hall and Soskice, 2001). Albeit this distinction is an ideal typical one and ideal types do not have an immediate expression in empirical reality, the United States are considered to be a prototypical example for the former and Germany for the latter. However, other nations have been characterized as hybrids mixing characteristic elements of both types (e.g. Campbell and Pedersen, 2007; Jackson and Deeg, 2006; more critically Arts and Gelissen, 2002). Other national economies have been described as objects of change, e.g. the UK and their strengthening of LME-characteristics or Sweden and their weakening of CME-characteristics (Freeman et al., 1997; Rhodes, 2000). Currently, there is a huge debate on how such changes can be explained theoretically and what mechanisms can be identified (Thelen, 2003; Campbell, 2004, 2007; Hasse and Leiulfsrud, 2002.)

It has been argued that the two types of capitalism differ profoundly with respect to their innovativeness and prevailing innovation strategies (Hollingsworth and Boyer, 1997). LMEs are considered to be appropriate for radical innovations which can be defined with respect to new production processes and to new products. Radical innovations are often based on the utilization of new research fronts. Typically, new actors enter the stage and new markets emerge. CMEs, by contrast, seem to be more appropriate for incremental innovations. Typically, incremental innovations are pushed forward by established actors who seek to improve their position in pre-existing markets.

As we will outline in the first section, the institutional configuration of Switzerland resembles the ideal type of CMEs. CMEs are said to be highly supportive for incremental innovations. Biotechnology, by contrast, is one of the most significant fields for radical innovations. Radical innovations "entail substantial shifts in product lines, the development of entirely new goods, or major changes to the production process." (Hall and Soskice, 2001, p. 38). As sectors which strongly rely on radical innovations, like biotechnology, find more supportive conditions in LMEs whose institutional setup is believed to result in competitive advantages for radical innovations, Swiss biotechnology comes as a surprise which deserves a closer look.

Our paper thus deals with the emergence and the development of the biotechnology sector in Switzerland which can be observed since the mid nineties. Special attention will be drawn to venture capital because the provision with sufficient capital is considered to be a pre-condition for the economic utilization of radical new knowledge. Such venture capital is seen as a necessary condition of biotechnology but it normally is to be found in LMEs.

The indication of the matter of fact that in Switzerland a market for venture capital for biotechnology has emerged is twofold: Firstly, it may be argued that characteristic features of LMEs can – more or less easily - be integrated into CMEs. If so, the concept of institutional configurations should not be overstressed. Instead, researchers should be more aware about the possibility of a loose coupling of institutional elements, because, in practice, institutional features can be combined in unique ways and with respect to functional requirements, normative expectations, and/or strategies of powerful actors. It should be noted, however, that this indication would weaken the entire idea of institutional configurations which lies at the heart of the discussion on varieties of capitalism. The second indication is related to issues of change – either of Switzerland as the empirical case at issue or, more generalized, of CMEs which generally may have adapted to new challenges by incorporating elements of LMEs. This second indication is currently heavily debated within the varieties of capitalism-discourse (Schmidt 2000; for a discussion of institutional change in Germany see also Lane 2003; Höpner, 2003; Vitols, 2005).

The case study of venture capital for biotechnology in Switzerland can be both related to the question of loosening the strength of the concept or to the issue of addressing institutional change and hybridisation. Our empirical focus is on how elements of LMEs which are related to radical innovation can be integrated in a CME context – i.e. we address issues of adaptation and change. For this purpose it is crucial to describe the emergence of venture capital for biotechnology-start ups in Switzerland historically and with respect to analytical dimensions. In so doing, we aim at discussing the potential of coordinated market economies to be successfully involved in technological sectors which are based on radical innovations.

In the first section we begin with analysing the institutional framework of Switzerland and characterize it as a CME. This characterization is based on the dimension "financing", "coordination mode" and "knowledge base". Then, we describe types of innovation in biotechnology and its spread in Switzerland. The second section deals with the finance market for biotechnology. In order to discuss to what extent this finance market is liberal or coordinated, we will utilize the same analytical dimensions as before ("knowledge base", "coordination mode", "financial strategies"). Empirically, this part is based on our own investigation of biotechnology startups in Switzerland.[1]

1. Institutional frameworks and biotechnology

1.1 Institutional frameworks

According to the Varieties of Capitalism framework, two basic types of capitalisms can be distinguished: liberal market economies (LMEs) and coordinated market economies (CMEs) (Hall and Soskice, 2001). Whereas companies in LMEs rely more on market mechanisms to coordinate their endeavours, companies in CMEs obtain higher levels of non-market coordination. Analytically, types of capitalism have been differentiated with respect to five institutional domains: (1) industrial relations, (2) vocational training and education, (3) corporate governance, (4) inter-firm relations and (5) coordination of own employees (Hall and Soskice 2001: 7). For our purpose of utilising this approach for understanding innovation patterns, we can regroup these domains to three dimensions: (1) finance, (2) coordination and (3) knowledge base. Subsequently, we will firstly describe the respective characteristics of the two capitalisms before secondly discussing the particular characteristics of Switzerland.

Finance

Ideal typically LMEs have market-based financial systems whereas CMEs obtain bank-based financial systems (Hall and Soskice, 2001; Jackson and Deeg, 2006, p. 13). Companies in LMEs are strongly dependent on their valuation on equity markets to secure finance and therefore have to focus on current profitability. Corporate control is exercised externally by the market of corporate control, which is also favoured by the regulatory regime. As capital markets require sufficient capital, it has also been argued that strong capital markets depend on the degree of income (in)equality and on the method of pension saving (Vitols, 2001a). In CMEs, companies have to a larger degree access to so called "patient capital" which enables companies to pursue more long-term oriented strategies.

[1] The project investigates in case studies of biotechnology start-ups and their institutional context. It is based on case studies and expert interviews with significant collaborators. Financial support has been provided by the Swiss National Fonds (SNF).

This also allows companies to more easily retain their workforce in times of economic downturn. Corporate control is exercised internally by dense networks between companies.

Switzerland is well known for its bank-based system which is strongly supported by the important role of banks in corporate finance and the "pay as you go" financed pension scheme. Similar to Germany, the role of the big banks is supported by their dense personnel and financial networks to the big listed Swiss companies. Property structures of Swiss listed companies are also highly concentrated. According to Nollert (Nollert, 2005, p. 406), 31,3% of the big Swiss companies is held by individuals or families, 30,3% by non financial companies and 25,3% by financial companies. In the last few years the role of the big Swiss private banks has changed to globally oriented financial service companies with a stronger focus on capital markets which has led to a reduction of allocated credits by them (Pedergnana, 2006). However, two-thirds of Swiss companies still have majority-held property structures (Beiner, 2005, p. 29).

Surprisingly for a bank-based system, the total market capitalisation (measured as a percentage of GDP) is very high in Switzerland and even outnumbers Anglo-Saxon countries (SFCW, 2007, p. 111), which indicates that market-based finance also plays an important role in the economy. The high market capitalisation can partly be explained by the high degree of income inequality (on a high level) with a relatively large number of high-income households in Switzerland. These groups are said to be highly supportive for market-based systems due to their greater capacity to invest and absorb short-term risks (Vitols, 2001a).

Coordination

The term coordination refers to the degree of regulating labour markets as well as to relations between companies. LMEs are known for their deregulated labour markets which facilitate hire and fire practices. This characteristic enables companies to adapt their strategies flexibly to changing market conditions. Relations between companies are usually based on standard market relationships and formal contracts which is also supported by a rather strict antitrust regulation.

In contrast to LMEs, CMEs have formally regulated labour markets that include generally higher levels of employment protection, higher wage replacement rates for unemployment, and institutions for labour participation in management and collective bargaining institutions such as work councils. These elements render labour markets of CMEs less

flexible. Inter-company relations in CME are more cooperative and several institutions support relational contracting among companies.

Switzerland appears to present a case which falls in the middle. Labour markets clearly are less regulated than in Germany though there are still moderate levels of employment protection and wage replacement rates. Relations between companies, however, are more in line with the CME-mode. They have similar origins than in Germany, namely the formation of cartels by the big private banks at the end of the 19th century. This structural element has persisted after the Second World War and it has been restricted only very hesitantly (Nollert, 2005, p. 167). Swiss corporate law also has several laws and procedures to support the strong personnel and capital links between companies that also enforce non market-based coordination between companies (David *et al.*, 2004).

Knowledge base

Education and skill creation are regarded as essential determinants of the overall system that also influences other institutional determinants (Jackson and Deeg, 2006, p. 17; Thelen, 2004). LMEs usually rely on organization-based qualification systems (Müller and Shavit, 1998), which strongly rely on skill development. Skill development is centred on generic and publicly visible skills, easily sold on highly fluid labour markets. LMEs, however, have higher amounts of university education, and the economic utilization of research can be realised more easily. Basic research, here, is less detached from the potential for application.

CMEs, by contrast, have high levels of vocational training, which creates highly industry-specific skills. As companies invest in these training systems, employee-employer relationships have a relative long-term horizon and promote competence-enhancing human resource development (Casper and Whitley, 2004, p. 95). Obviously, the production structure of CMEs relies on a highly skilled labour force. Higher education, by contrast, is less widespread. Scientific research, correspondingly, is either tightly integrated into industries with close bonds to big corporate actors or it is rather decoupled from any economic utilisation.

Switzerland's training system is based on high levels of vocational training (Hotz-Hart, 2003, p. 48). This can be partly explained by the fairly low return on higher education in Switzerland in terms of income. As a result, the percentage of Swiss graduates averages 13 % which lies far below the OECD average of 25,9% (Dümmler, 2004, p. 5). This lack of degrees in higher education corresponds with a high degree of internationalization of PhD students, researchers and professors at Swiss universities. Thus, one may argue that

in higher education and in basic research, Switzerland imports its workforce to a substantial extent. Public spending of R&D is far below OECD average. It is predominantly invested in public research institutions which, in the case of Switzerland and due to a lack of other public research institutions, can almost be equated with universities. Though public spending is low, Switzerland ranks quite high in total spending in R&D. This indicates that the contribution of the industry sector is fairly high.

1.2 Biotechnology

It has been argued that institutional arrangements have profound impacts on innovation and help to explain different innovation strategies and structures (Hollingsworth and Boyer, 1997; Casper and Whitley, 2004, p. 90). Accordingly, the highly flexible deregulated labour markets, the focus on generic skills and the supply of market-based finance in LMEs encourage companies to innovate in rapidly moving technology sectors which strongly rely on radical innovations. The term radical innovation hereby refers to substantial shifts in product lines, the development of entirely new goods or major changes in the production process. This type of innovation is said to be important in fast-moving technology sectors like biotechnology, which also strongly rely on research.

CMEs are said to have comparative institutional advantages in sectors that are characterized by incremental innovations, i.e. continuous but small scale improvements in existing product lines and production processes. This type of innovation is supported by industry-specific skills of the workforce, stable, long-term employee relationships and patient, long-term oriented capital. It is also based on dense relations between specialised research institutions and big companies. Note that these relations can be expected to match with the overall mode of coordination. It thus may be concluded that Switzerland has comparative institutional advantages in technology sectors which predominantly rely on incremental innovations.

Varieties of biotechnology

Biotechnology is often seen as one of the most promising technologies of the future. According to the definition of the OECD (OECD, 2006, p. 5) biotechnology implies the "application of science and technology to living organisms, as well as parts, products and models, thereof, to alter living organisms, as well as parts, products and models thereof, to alter living or nonliving materials for the production of knowledge, goods and services. Particularly important in this definition is the use of living organisms and their alteration (see also Fuhrer, 2005, p. 9). According to the definition of the Cambridge Health Insti-

tute[2] one can differentiate between three biotech sub-sectors: Biotechnology Therapeutics[3] (www.swisslifesciences.com), Biotechnology R&D Services[4] (www.swisslifesciences.com) and Biotechnology Others[5] (www.swisslifesciences.com).

When classifying the three sub-sectors in terms of radical vs. incremental innovations, it is obvious that only the first definition suits the characteristics of a radical innovation. The development of new therapeutics involves intensive research combined with a high failure risk and a considerable amount of capital required. In contrast to the first sub-sector, the other two sub-sectors are more in accordance with the characteristics of incremental innovations. They involve less risk and their business models are similar to companies in e.g. engineering or manufacturing which also profit from industry or firm-specific skills of the workforce and credit-based finance.

Firms can specialize on either innovation type of biotechnology, but they can also aim at a combination. Some firms, e.g., concentrate on both new drug development and developing platform technologies with the latter being offered to other research institutions. Though such non-specialization limits both the potential for specialization and the utilization of economies of scale, it is more widespread than expected. Some startups, e.g. start with developing platform technologies, set up business relations on that basis, and gain status and reputation as competent and reliable business partner. Against this background they plan to develop new drugs at a later stage of their life cycle (Duschek, 2008).

The emergence of biotechnology in Switzerland

The emergence of the Swiss Biotech sector can be dated back to the mid-nineties, which in comparison to the USA, is quite late. The development was fostered by the merger of the two big Swiss pharmaceutical companies Sandoz and Ciba-Geigy at the beginning of 1996, which is today known as Novartis. At the same time Biotechnology became more and more important for the pharmaceutical sector. Therefore, companies like Roche and Novartis have not only hived off their own companies in the following years but they have also established cooperations with biotech companies.

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[2] The CHI obtains a recognized glossary for biotechnology which is also used by the Swiss life sciences data base.

[3] „Biotechnology is, broadly speaking, the applied use of living organisms or their components to make or modify products, to improve plants or animals and to develop microorganisms for specific uses. A narrower definition, (often called "new" or second-generation biotechnology), restricts the term to the use of recombinant DNA, monoclonal antibody and other modern techniques arising from applications of molecular biology."

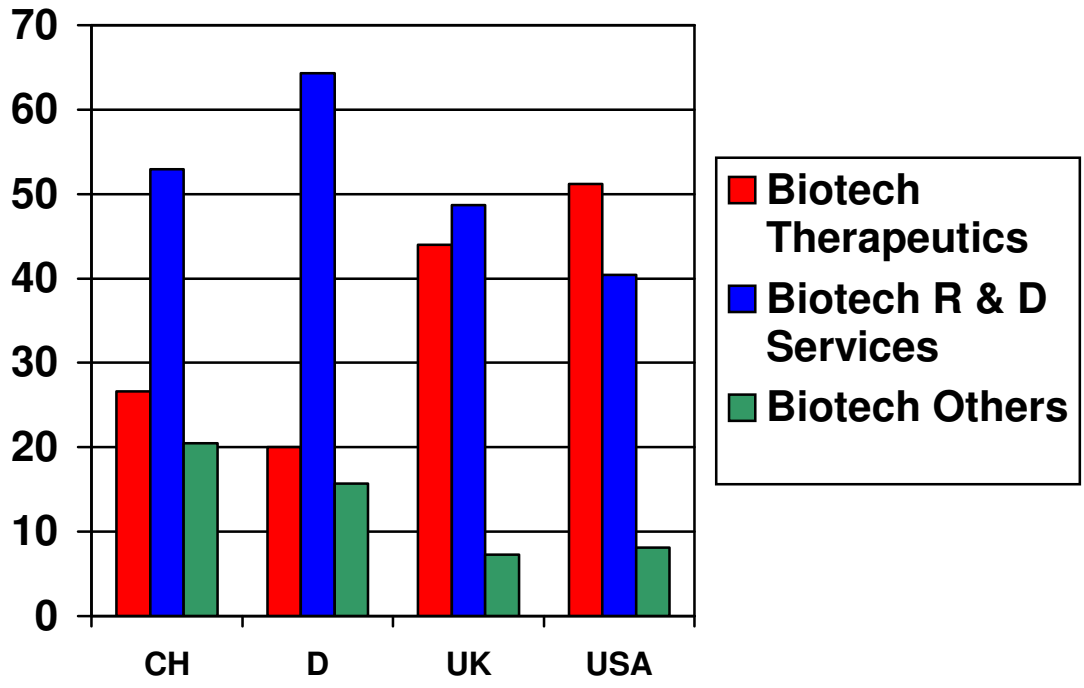
[4] „Biotechnology/ R&D Services are the tool companies providing the picks and shovels of the biotechnology industry."

[5] Companies of this category do not conform with the narrower definition of Biotechnology but their products and services are very close to this industry or strongly related to this area, respectively.

Swiss universities have also become more active during the nineties in supporting university spin-offs by founding technology transfer offices and providing courses on company foundation and entrepreneurship. The importance of universities for biotechnology is also observable by the clustering of biotech companies around the universities of Zurich, Basel and Geneva/ Lausanne (Zeller, 2005; compare also Niosi and Banik, 2005 for similar results). These areas have also established several technoparks for their spin offs.

Swiss biotechnology companies also can be characterized with respect to sub-sectors. The results of such a breakdown are in line of what can be expected in CMEs. More than 50% of the companies belong to R&D service companies. The third category "Biotechnology Others" comprehends 21%. Thus, the majority of Swiss biotech companies are active in sub-sectors where incremental innovations prevail, which is perfectly in accordance with the institutional characteristics of Switzerland's CME.[6]
LMEs, by contrast, have a share of +/- 50 % in Biotech Therapeutics. However, at least 26% of Switzerland´s Biotech companies are active in the therapeutic sector, although the institutional framework is said to disadvantage this type of innovation. Therefore the question arises, to what extent does this sub-sector fit into the institutional arrangement of Switzerland`s CME?

Figure 1



[6] It should be noted that this breakdown is even more pronounced for Germany as a more pure case of coordinated economies (Figure 1).

2. Characteristic features of therapeutic biotech finance

As finance plays a decisive role for therapeutic biotech companies, we will subsequently discuss characteristics of therapeutic biotech finance in Switzerland. Investments in highly uncertain technologies like biotechnology are a very risky business and often fail, but at the same time expected returns can be very high (Thalmann, 2004; Taga and Forstner, 2002, p. 117). According to the model, equity capital predominantly is to be found in LMEs where it supports research and development on radical innovations. Within equity capital a formal and an informal market can be distinguished (Haemmig, 2003; Riffelmacher, 2006).

The formal market is composed of venture capital and corporate venture capital. Its characteristic elements can be described as follows: The provision of research intensive companies with capital (and with corresponding services) requires a highly sophisticated workforce. Most often venture capitalists hold a higher degree in finance or economics, but to some extent they also must solve the problem of evaluating the projects of their clients from a technical point of view. Thus, specialized experts from science or engineering tend to be incorporated into venture capital teams. Often, they hold a PhD and have been actively involved in research before. Another characteristic feature of a former venture capital market is a sufficient number of actors on the supply side and on the demand side. This feature can be seen as a functional requirement for triggering market mechanisms. If there are not sufficient actors on one of the two sides, by contrast, prices can be determined by other mechanisms. As a consequence of a large number of venture capitalists, specialization with respect to regions and technology fields are to be found. Additionally, finance actors tend to concentrate on venture capital instead of getting involved in other finance activities.

In the informal venture market, by contrast, capital is provided by business angels. Business angels are wealthy individuals with an entrepreneurial and/or managerial background. They do not only invest their own capital but often also support startups with their business experience and with their well established networks. Most often, business angels invest in sectors or technologies they are familiar with. Additionally, business angels tend to prefer investments close to their residence in order to keep in touch with the day to day-practices of the companies they support. However, business angels do not need to be aligned with the respective company. Neither do they get involved as co-founders, nor are personal relations of friendship or kinship a characteristic feature (Riffelmacher, 2006, p. 6; Fueglistaller et al., 2004, p. 265).

In Switzerland, we can identify four different types of players who are active in the risk capital market for biotechnology: (1) venture funds which, in theory, are characteristic for

LMEs, (2) the corporate venture fund of Novartis, the pharmaceutical giant which is heavily interested in the utilization and marketing of new drugs, (3) business angels who either provide just money or also play an active role within the company, and (4) the cantonal banks. The big private banks (Credit Suissse and UBS), by contrast, do not invest in the biotech sector. In what follows we will discus the venture capital market in Switzerland. In order to do that analytically, we will refer to those three dimensions which can be utilized in order characterize contemporary market economies. We begin by discussing the knowledge base venture capital providers, then draw our attention on prevailing modes of coordination, and finally discuss financial strategies. In so doing, we can tackle the issue of institutional variation and change of Switzerland as given institutional context.

2.1 Knowledge base

Venture capital firms provide their clients with capital, and typically they also offer financial services and access to networks (for the different functions of venture capital firms see also Castilla *et al.*, 2000, Cohen and Fields, 2000, Kenney and Florida, 2000; Suchman et al., 2001; Saxenian, 1994). These services – as well as the selection of clients – require knowledge from financial experts. An academic background in finance or economics thus seems to be the most appropriate qualification for venture capitalists. However, venture capitalists must also evaluate the research & development of their potential clients. Firms may collaborate with specialized scientific experts in order to evaluate issues of research & development of their potential clients. They can also incorporate scientists in their teams. In practice, the technological knowledge of venture capitalists is often limited, but they can cope with this deficit by specializing in certain technological fields, in which they can develop and improve their competences.

Against this background one may be taken by surprise that in Swiss venture capital teams technological and scientific knowledge is widespread. A scientific background in pharmaceutical sciences, often with a specialisation in genomics, virology or genetics, seems to be the rule and not the exception. Some members of venture capital firms also hold a PhD in microbiology. As a rule, career paths do not start within a venture capital company but with research and then managerial experience in the pharmaceutical industry. To be precise, venture capitalists often have worked before at one of the two big pharmaceutical companies Roche or Novartis (formerly Sandoz and Ciba-Geigy). Some venture capitalists have also completed an executive training program (e.g. at Harvard Business School). In particular, CEOs have acquired such further training. Furthermore, there is frequently one or at maximum two persons who hold a business degree. These economic and finance experts gained business experience not in the financial sector but in consulting companies

like Ernst & Young and PWC. It also should be noted that this is not the CEO who traditionally has a technological (science) background.

Venture capital firms are not the only institutions which provide Swiss start-ups with capital. However, the qualification structure within the industry venture fond is quite similar, which is more plausible as former careers within the two big pharmaceutical companies were generally not focused on business but rather on technology. It thus may be argued that, in comparison to what has been said about venture capitalists in more liberal market economies such as the US, technical competencies are more sophisticated and widespread while financial and business competences are less pronounced.

The academic background of business angels cannot be generalized: Some have a scientific background but business degrees can also be found. There seems to be a tendency that business angels from the Basel region, where the chemical industry is concentrated, have more often pharmaceutical experience due to their former employment by Roche or Novartis whereas their colleagues from Zurich, which is the finance-center of Switzerland, have generally not worked within this area. This also confirms the fact that business angels prefer local investment, and it indicates that business angels reflect the knowledge of their region. Regardless to such different specializations, business angels have a long time working experience within one or several companies.

The qualification structure within the cantonal banks is in sharp contrast to the research-based workforce in venture capital teams. Cantonal banks are public institutions which are deeply embedded in the local economy. I some cases, they provide start-ups with capital, either to gain profit in the distant future, or to gain legitimacy due to the high status of technology start-ups. In cantonal banks employees most often hold a business degree from university or polytechnics, but generally not a PhD. Accordingly, cantonal banks do not specialize in particular sub-sectors or sub-fields of biotechnology. Therefore, they consult external advisors to evaluate projects and select promising candidates.

As the case of the cantonal banks is exceptional, the qualification structure of the workforce which provides start-ups with venture capital is not primarily based on an academic background in finance or economics. Such emphasis on technological competences is rather typical for CMEs. It resembles Germany`s qualification structure at times of the Deutschland AG which, among other things has been characterized by CEOs holding an engineering background instead of formal qualifications in business and finance. It thus may be concluded that venture capital in the institutional context of CMEs is primarily

based on technological competences, which facilitates cooperation between venture capitalists and their clients.

2.2 Coordination

Seen from an abstract point of view, risk capital is in need for a large number of potential clients. First, it is important to select the most promising start-ups from those which focus upon less promising projects. Second, the risk of investments in start-ups with high profit chances only can be reduced to a feasible extent if a large number of candidates compensate the low success probability of a single project. Start-ups, by contrast, can benefit from low degrees of concentration of venture capital as negotiations between demand side and suppliers are more power balanced. Additionally, dense competition triggers specialization and makes it more likely to find an appropriately specialized venture capitalist.

Switzerland, by contrast, is to be characterised as a small number-market. Actors know each other personally, and offer and demand are rather limited in comparison to US technology clusters. Accordingly one interview partner has explained that "if one is part of the real risk capital scene, he or she gets to know every dossier which will pass". Probably as a result of size, the allocation of risk capital in therapeutic research displays high levels of non market coordination. Terms and conditions are not subject to free negotiations between start-ups and venture capitalists. Instead, they result from collective cooperation through arrangements between the different venture capitalists. As similar effects are also reported for locally situated venture capitalists in the Bay Area, this may partly be explained by the small number of venture capitalists in Switzerland. While in California non local venture capitalists enter the stage as soon as a considerable excess demand for venture capital emerges, Swiss biotechnology remains largely a domain for Swiss venture capital.

The coordination between venture capital companies is also supported by the fact that their CEOs often are members of several supervisory boards of biotech companies. This linkage between finance and production clearly resembles personal and financial linkages of banks and industry which are a characteristic element of CMEs. As a result for biotech companies, risk capital is available in Switzerland but it is reported to be more expensive than in LMEs with a higher amount of competition among venture capitalists.

Coordination modes of business angels resemble the one of corporate venture funds. Business angels are generally organized in local clubs. Business plans are either selected after a presentation in one of the clubs or through recommendation of another business angel. Typically (and similar to venture capitalists), there are three or four business angels

who decide to invest and they select one of the business angels who take an active role in the company. This involvement then ranges from being chief executive to providing a company with access to networks. Business angels may also deal with marketing issues or with the acquisition of new investors.

The allocation of risk capital by cantonal banks differs due to the very specific features of cantonal banks. Cantonal banks are restricted to the respective canton – a politically defined local territory. As a consequence, there is no competition, cooperation or specialization between the different cantonal banks as, e.g., the cantonal bank of Zurich is not designated to invest in Start-Ups in Basel or Geneva. It also should be noted that cantonal banks are not represented in the supervisory boards of biotech companies. This difference helps the banks to avoid potential conflicts of interest. It also reduces responsibilities which in the case of cantonal banks as public institutions may be more pronounced. Again, however, cantonal banks are exceptional and only rarely made use of. The structure resembles the way thrifts and cooperative banking associations in coordinated market economies are committed to small and medium enterprises in their regional context.

As the market is small, players also participate in the same networks. Actually, investment decisions often are made on the basis of recommendations of competitors. Accordingly, one interview partner of a cantonal bank has explained that they often co-invest with venture funds and business angels where positive experiences have been made with and where a similar understanding of business ethics and culture can be found. Furthermore, the different players are rather complementary to each other in terms of investment and (in most of the cases) do not compete with each other. As a consequence, reputation is a crucial resource for start-ups to successfully acquire capital.

Though cantonal banks are exceptional capital providers, it can be argued that modes of coordination are applied which are characteristic for the institutional context of CMEs. This holds also true for private venture capitalists whose sheer existence often is assumed to be a characteristic feature of LMEs. In Switzerland, private venture capitalists have not contributed to an erosion of generally close linkages between finance and production. Instead, they have adapted to – and strengthened – this characteristic feature of CMEs. Thus, one may not be taken by surprise that venture capital in Switzerland has developed a degree of coordination which in LMEs would be rather unusual.

2.3 Financial actors' strategies

The characteristic feature of venture capital is to invest in early stages of a product development. These investments are extremely risky, because return on investment is in the

distant future. Additionally, it is rather uncertain whether any return can be expected, because of a low success probability. Compared with this characteristic, investment strategies of venture funds appear to be rather risk averse in Swiss biotechnology. Venture capitalists clearly prefer to invest in later stages. They do not, for example, give money to projects which have not passed the clinical test stage (phase 2a)[7]. Lack of dense competition among providers with venture capitalist and the high degree of coordination between them result in the reproduction of this practical rule.

Although it is also reported that venture capitalists elsewhere tend to avoid early stage financing (Taga and Forstner, 2002, p. 23), their entrance is much earlier than those of their Swiss counterparts (phase 1 and before). In this respect it may be concluded that such a more pronounced risk aversion is a typical characteristic of CMEs. The restriction to financing only later stages of drug development was only weakened during the investment boom at the turn of the century. Thereafter, investors regretfully returned to more risk-averse strategies as in Germany after the investment crash in stock equity (Vitols, 2001b).

Not financing early stage-research indicates that there is a sufficient number of potential clients which could be provided with venture capital in order to continue with research and development. Early stage-provision with capital seems to be sufficient as there are no indicators for a shortcoming of clients which have survived these early stages. Sufficiency of clients, of course, is to be seen as a function of the number and density of competing venture capitalists. As competition is weak, no early stage financing is to be expected.

In sharp contrast to venture funds, the industrial venture fund and the cantonal banks invest early stage. It should be noted, however, that in both cases there are other rationalities involved. The industrial fond has primary the strategic orientation of finding new deals for its parent company as Novartis cannot pursue all research by itself. Early stage financing predominantly is to be seen as an investment in research. It is an alternative to in-house research, and to a much lesser extent as a financial investment in the stricter sense. Additionally, in-licensing also presents a way to benefit from current research by minimizing the downside risk at the same time. It also presents a way to control the pharmaceutical sector and to keep a centre position within the innovation network. As the fund is financed

[7] Drug development proceeds through a long process (see also Hinze et al., 2001). At first, preclinical studies are conducted, involving in vitro and in vivo experiments. Afterwards, clinical trials are started which usually contain four phases. In phase 1 the drug is tested on a small (20-100) group of healthy volunteers. In phase 2 the drug is tested on larger groups (100-500) of patients, suffering from the disease. Phase 2 is often divided into two sub phases: phase 2a and phase 2b. Phase 2a assesses dosing requirements, phase 2b studies the efficacy of the drug. In phase 3 the drug is tested on large patient groups (500-3000) over a longer period of time. Phase 3 is the most expensive phase.

by its parent company, it is obviously not so much dependant on financial performance than its venture counterparts.

Business angels sometimes also invest early stage. Generally, they have already been successful in the business world and they actively want to "help to get a start-up started from scratch." In such cases they do not give money without their own participation, and motivation cannot be reduced to strict financial investment as a means to make profit.

For cantonal banks, finally, the financing of small and medium companies of the regional economy is an integral part of their activity. They can symbolically utilize such investments for signalling their responsibility for the socio-economic context. In order to understand this strategy it is important to take the very specific character of cantonal banks into consideration. The most prominent is their protection by government liability which is comparable to German thrifts (Sparkassen). Furthermore, their aim (as codified in the statutes) is not to maximize profit but to support and contribute to the economic development of the respective canton. Finally are cantonal banks a public institution which each canton has. To put it bluntly: cantonal banks are regionally powerful and important non profit-organizations.

In the 1990s some cantonal banks of research intensive regions started a program to support high technology start ups in their respective canton. Risk capital is allocated either by convertible bonds or mezzanine money. The program supports a limited number of companies (ca. 20 per year) according to an investment limit of 15 Mio CHF per year which is already written off in the balance sheet. It also follows from the organizational type of cantonal banks that they are not exclusively aiming at making profits. Firstly, providing start-ups with risk capital can also be used for achieving legitimacy. Supporting young innovative companies is highly appreciated by the public and by the media. It therefore is very supportive for their reputation and "self-marketing". Accordingly, in an expert interview which has been conducted in line with our research project, one interviewee emphatically claimed "that the primary aim is not to make money but to be part of a success story." Secondly can cantonal banks set up relations, because they are at the centre of the regional economy of their canton. Providing start ups with capital sometimes also is seen as an investment in potential follow-up business. Such follow ups, then, corresponds more to the traditional business of banks and thrifts like financial security, loans, assurances, etc.

To conclude, one can observe the emergence of a risk capital market in Switzerland which supports the development of therapeutic companies. As venture capital markets are a cha-

racteristic element of LMEs and corresponding innovation paths, it comes as a surprise that we do find it in Switzerland which can be seen as a variant of CMEs. A closer look at this market and its actors, however, offers some explanation: Business relations do not function on market based coordination. Instead, there is a small number of suppliers whose institutionalized interests in making profit differ. Nevertheless there are close bonds between these suppliers. Suppliers of venture capital can easily observe each other and develop common standards and principles. They may even communicate the evaluation of potential clients which makes reputation a crucial parameter for start-ups. Summing up, it may be argued that in Switzerland a coordinated form of risk capital has developed. Its characteristic features nicely fit into the broader institutional arrangement of Switzerland as a coordinated market economy.

Conclusion

Based on case studies from Switzerland, this paper has dealt with biotechnological innovations and their provision with venture capital. In the first part, we have described both the institutional framework of Switzerland and characteristics of the biotech sector. While Switzerland was characterized as a variant of coordinated market economies (CMEs), biotechnology was shown to be a technological field where both radical and incremental innovations are to be found. With respect to the latter, we found evidence that biotechnology in Switzerland predominantly is emphasizing upon instrumentation and services. As instrumentation and services is a sub-sector of biotechnology that is characterized by incremental innovations, such an emphasis corresponds with the institutional setup of Switzerland as CME. However, there is also research on therapeutic development which aims at radical innovations. As radical innovations find more appropriate conditions in liberal economies this is a rather surprising phenomenon.

Because one crucial requirement of radical innovations is provision with sufficient venture capital, the second part of the paper has dealt with the emergence and with characteristic features of the risk capital market in Switzerland. The provision with risk capital is said to be particularly important for the development of therapeutics but rather untypical for CMEs. In order to analyse the venture capital market, we have described it with respect to its knowledge base, its mode of coordination, and financial strategies. Because any of these dimension offer criteria for distinguishing between coordinated and liberal economies, we could show that a type of risk capital industry has emerged that nicely fits into the institutional context of coordinated economies. In this respect, the emergence of a risk capital market is not to be seen as a radical institutional change in Switzerland.

Two main conclusions can be drawn from our case study. Firstly, a closer look at the variety of innovation types of a certain technology allows us to explain that technologies may fit into a broad range of institutional configurations. Our differentiation by sub-sectors of biotechnology has shown that some of those are perfectly in accordance with the institutional framework of CMEs. Basic technologies such as biotechnology are thus incorporated selectively and with respect to institutional characteristics of the national context. Secondly, the case sheds light on issues of stability and change of institutional configurations. By taking a closer look at characteristics of the risk capital market in Switzerland, we have shown that new institutional elements can be incorporated which are rather untypical for CMEs. However, financial strategies, modes of coordination and knowledge bases of these risk capital markets are formed in accordance with characteristic features of CMEs.

Summing up, one may argue that technological innovations (e.g. therapeutic development in biotechnology) have the effect that some elements of LMEs (such as risk capital) easily can be incorporated into CMEs. Institutional arrangements are thus more flexible than it is often assumed. They are responsive to changing conditions and aim at utilizing new technologies though innovations might require adaptations of the institutional set-up. However, it could be shown that they do so incrementally and in accordance with the overall institutional configuration.

The extent at which, in the longer run, such changes trigger further adaptations and more profound forms of institutional change currently cannot be estimated. However, it might be speculated that new actors such as biotechnology start-ups and venture capital companies put pressure on the strategic orientation of established ones (e.g. Swiss banks), that new qualification profiles gain strength (e.g. academic education) and, correspondingly, that new forms of co-ordination (i.e. market mechanisms) get hold. If so, this would hint at more pronounced changes – and it would be important to know whether such long run-incremental variations are the typical mode of social change in CMEs (whereas radical social change might prevail in LMEs).

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